

## **Introduction**

Thank you for joining us as a user at the Los Alamos Neutron Science Center (LANSCE). LANSCE is located at Technical Area 53 (TA-53) at the Los Alamos National Laboratory. LANSCE is a world-class linear accelerator facility. Our primary experimental areas are the:

- Lujan Neutron Scattering Center (Lujan Center),
- Weapons Neutron Research Facility (WNR),
- Proton Radiography Facility (pRad), and
- Ultra-Cold Neutron Facility

## **Purpose**

This study guide will help you understand potential hazards at LANSCE. It describes the controls in place to protect you, other workers, and the environment and explains how to respond to abnormal events or emergencies.

The guide is divided into three sections- the first section addresses general information that all users should know; the second section addresses specific hazards and controls at WNR; the third section addresses specific hazards and controls at the Lujan Center.

Although acronyms are defined in the text, a list is also included at the end of the guide. Definitions to words you may not be familiar with are also included.

After you read this study guide, you will take a short quiz at the LANSCE Training Office to demonstrate your understanding of the material. You must score at least 80% on the quiz to access the experimental areas as a User.

## **Section I: General Information for All Users**

### **1. Contacts**

Your local contact or instrument scientist will help you with technical issues. The LANSCE User Office (505-665-1010, [lansce\\_users@lanl.gov](mailto:lansce_users@lanl.gov)) will help you with any other questions.

### **2. Special Access Needs**

If you are undergoing any internal medical radionuclide therapy, please report this to the LANSCE User Office before you arrive. The radiation detection monitor at the main gate is very sensitive, which may sound the alarm as you enter or leave TA-53. It may be necessary for Health Physics personnel to meet you at the main gate whenever you enter or leave the area. Additionally, the Dosimetry Services Group, HSR-12, may need to correct readings from your dosimeter badges.

A woman who is pregnant may volunteer to declare her pregnancy to the User Office before going into an experimental area or the accelerator complex when radiological hazards exist. Declared pregnant workers receive advice and recommendations about radiation exposures from

the Reproductive Health Hazards Program (RHHP), which is managed by the Laboratory's Dosimetry Services Group, HSR-12.

### 3. Access Controls

Follow these steps for driving into the LANSCE site and going to the Visitor Center.

If you are...	Then...
A U.S. citizen	1.Stop at the TA-53/ LANSCE guard gate on La Mesita Road, off of East Jemez Road.
	2.Show photo identification to the guard at the gate. The guard will confirm that the User Office expects you. If the guard does not have your name on the list, pull over and park in the area next to the guard gate. Use the telephone outside the guard gate and dial 5-1010 (the User Office). If there is little traffic, the guard can call for you.
	3.Drive to the User Office in Building 1, which is the first building on the left, approximately 0.3 miles from the guard gate. The User Office provides badges and other necessary material and direct you to the Training Office for training.
A non-U.S. citizen	1.Receive an official picture identification badge at the Los Alamos National Laboratory (LANL) Badge Office at TA-3, building 200 (the Otowi Building), before driving to LANSCE.
	2.Stop at the TA-53/ LANSCE guard gate on La Mesita Road, off of East Jemez Road
	3.Show your LANL picture identification badge to the guard. Wait until the guard directs you to continue.
	4.Drive to Building 1, which is the first building on the left approximately 0.3 miles from the guard gate. The User Office provides materials and other necessary material and will direct you to the Training Office for required training.

Every time you enter LANSCE during normal work hours (6:30 a.m. to 6:25 p.m., Monday - Friday) you are required to stop at the guard gate and show your official visitor badge.

After normal work hours or on weekends, the gate is closed, and there is no guard at the gate. Open the gate from your car by running your badge through the badge reader located just past the guard station. Insert your badge so that the metallic strip on the back contacts the badge reader (upside down and backwards compared to other badge readers at the Laboratory). The badge reader automatically opens the gate when it recognizes the code on your badge.

You do not have to show your badge to leave LANSCE. During normal work hours, drive slowly past the guard gate but do not stop unless the guard signals you or an alarm sounds. After work hours or on weekends, open the gate from your car by pushing the green button located next to

the badge reader. If the gate does not open, run your badge through the reader. For this particular badge reader, hold your badge upside down with the magnetic strip facing you. Run your badge through the slot from the bottom to the top (which is opposite of the usual direction).

The gate will close immediately after your car passes through. If another car goes through the gate before you, you still need to push the green button or use the badge reader so that the gate does not close early.

If you set off the gate alarm while exiting LANSCE, pull into the parking lot across from the guard station. Use the telephone near the gate to call the Health Physics Office (the number is posted near the telephone). The alarm is part of the radiation-detection system at the main exit gate. If the system detects radiation as your vehicle leaves the site, the alarm will sound. A camera takes a photo of any vehicle that causes an alarm, so please save the embarrassment of a “manhunt” by waiting in the parking lot for Health Physics personnel.

LANSCE controls access to many buildings and experimental areas with badge readers. Once you complete training, the Training Office enters your badge into the badge reader systems for areas to which you require access. Each person who enters or exits a door with a badge reader should run his or her badge through the badge-reader system.

#### **4. Tag Your Bag**

One of your first tasks when you arrive is to tag all bags (briefcases, laptop cases, etc.) you bring to LANL. The Training Office maintains a supply of tags for your bags. Be sure the tag includes your name and a telephone number where LANL personnel can reach you while you are at LANL. LANL considers untagged bags to be safety and security hazards. Therefore, it is important that you do not leave your bags unattended and if you do so, that they are tagged. Untagged, unattended bags are usually destroyed by security personnel.

#### **5. Working Safely**

All workers and visitors at LANL are links in a safety chain that creates a safe work place. Each person in the chain must work safely, help others work safely, and protect the environment. The safety chain starts with you (the user) and flows upward to the acting LANL Director, -Pete Nanos. Before you begin work, find out who your safety- and environment-responsible line manager is. It is usually your host or local contact’s group leader or deputy group leader. Ask your host/ local contact if you are unsure.

#### **6. Worker/ Work Authorization**

As part of the experimental review process, LANSCE safety staff and line managers review your proposal to ensure that appropriate hazard controls are in place. Your host group line manager authorizes your experiment to take place. Your host group line manager authorizes you, the experimenter, to perform the work described in your proposal. Do not deviate from your work scope without consulting with your host, local contact, or the instrument staff.

#### **7. Stop Work**

Never take short cuts with safety or security. You have the right and the responsibility to stop work if you think it is not safe. If you see a person working dangerously, take action. First, talk to the person and explain the danger. If the person does not agree with you, and you still think there is a danger, notify your direct safety link (host, local contact, or instrument scientist).

At times, users spend long hours at LANSCE. Lack of sleep may pose a safety hazard by affecting your judgment or physical reaction time. For example, the National Highway Traffic Safety Administration reports that a sleep-deprived person drives a vehicle as poorly (or worse) than someone who is fully intoxicated, causing approximately 100,000 motor vehicles accidents and 1,500 deaths annually. The lesson to learn from this is:

STOP work in LANSCE experimental areas if you are sleepy.

## **8. Wear Appropriate Footwear**

When working in experimental areas or anywhere along the primary beam lines, wear protective footwear. This means at a minimum, closed-toe/ closed-heel shoes that cover your entire foot. No sandals are allowed.

## **9. Do Not Eat or Drink in Experimental Areas/ Beam Lines**

Do not carry food, tobacco or cosmetic products into experimental areas, or in any beam line. Eating and drinking is prohibited, primarily as a contamination control measure.

## **10. Read Postings**

TA-53 posts hazard warning signs at area entrances and exits to alert you to hazards and necessary precautions. The most common postings are for radiation, confined spaces, magnetic fields, noise, and some chemicals such as lead, mercury or beryllium. If multiple hazards are present in an area, there will be multiple postings. Look carefully at all the postings in an area before you enter or exit.

## **11. Hazards and Response**

The following sections describe general hazards at LANSCE, how we control them, and how we respond to them. Your local contact or instrument scientist will help you understand unique hazards applicable to the work you perform here.

**11.1. Electrical Hazards.** Electrical hazards are some of the greatest hazards at LANSCE. As a User, you are allowed use computer workstations, photocopiers, and Nationally Recognized Testing Laboratory (NRTL) approved equipment. For any other electrical work, consult with your host. If you bring non-NRTL electrical equipment with you, be sure to work with your host group before you use it.

We use locks and tags to control electrical hazards. Locks and tags prevent injury to workers during maintenance or the servicing of electrical equipment and other hazardous energy sources. NEVER remove or by-pass locks or tags. Do not try to use equipment that has locks or tags. The only person who can remove locks and tags is the person who put them on.

If you see an electrical accident involving a worker, follow the steps listed below.

<b>Steps</b>	<b>Action</b>
1	De-energize the circuit if you can do it quickly.  <b>Note:</b> If you cannot de-energize the system, use a nonconductive item to move the victim away from the electrical source. Examples are wooden or

	plastic sticks or cotton clothing used like a rope. Do not touch the victim through normal layers of clothing.
2	Call for help. Dial 911 from a LANL telephone or cellular phone. The 911 dispatcher will contact emergency response personnel and the LANL Emergency Management and Response team.
3	Provide first aid if you are trained to do so. <b>Note:</b> Do not move the victim if possible.
4	There are defibrillators in some areas of the accelerator complex and experimental areas. If the victim's heart is not beating, you may use a defibrillator. As soon as you activate the defibrillator, the machine "talks" you through the steps to take.
5	Remain at the scene until professional help arrives.

**11.2 Radiation Hazards.** Residual radiation from the accelerator beam, targets, and beam line components help produce four main types of radiation:

- neutron,
- beta,
- gamma

Occasionally we have alpha-radiation hazards when workers use alpha-emitting radionuclides for experiments or from residual radiation in targets.

Depending upon your work and the areas you will access at LANSCE, you will receive "Radiological Worker" or "General Employee Radiological Training." The training describes general radiation hazards and controls.

Everyone at TA-53 commits to keeping radiation exposures As Low As Reasonably Achievable (ALARA). The basic strategy for ALARA involves efficient use of time, distance, and shielding to limit exposure to radiation sources. ALARA is designed into our systems and operations, but each individual is responsible for thinking about their actions to keep their radiation exposures ALARA.

LANL uses various dosimeters to monitor workers' exposures to external radiation. The LANSCE User Office in Building 1 issues you a thermoluminescent dosimeter (TLD) after you complete your training requirements. It measures beta, gamma, x-ray, and low- to mid-energy neutron radiation doses.

Wear your TLD above the waist, with the silver foils facing outward, at all times while at LANSCE. Do not leave it on your car dashboard because heat may affect the dose reading. At the end of your visit, return your dosimeter(s) to the User Office in Building 1. Do not pack your dosimeter in luggage to check at the airport! X-ray devices at airports may cause a significant dose to be recorded on your dosimeter.

When you are here for an experiment, you will also receive a PN-3 Personal Neutron Dosimeter (sometimes referred to as a lemon badge), which measures neutron radiation energies greater than 200 keV (thermal electron volts).

Wear your PN-3 above the waist, beside your TLD, with the flat side against your chest, at all times while at LANSCE.

You are responsible for reading and following the instructions of all safety signs at LANSCE, including radiological postings. Exit signs may contain specific requirements to exit an area.

At times, Radiological Work Permits (RWPs) establish controls for certain activities and are posted at access control points. If you are assigned to perform a job governed by an RWP, review the document to learn about the task-specific radiological conditions and controls before performing the work.

During accelerator operation, the LANSCE Health Physics Field Office is staffed by Radiological Control Technicians (RCTs) twenty-four hours a day. If you need an RCT and cannot find one in the immediate area, contact the Central Control Room (CCR) at 7-5729 to page an RCT or call 7-7069. The CCR directs beam operation and tracks conditions in the accelerator complex 24 hours per day.

**11.3. Radioactive Material Hazards.** Volume-contaminated or -activated material is the most common type of radioactive material at LANSCE. When particle beams or secondary particles interact with material, the material may become radioactive throughout. We call this material “volume contaminated” or “activated.” The material may remain volume contaminated for minutes, several weeks, or longer. Volume contaminated material could include samples, experimental apparatus, beam-line components, targets, shielding, and other materials.

We follow administrative controls for handling and moving volume-contaminated material. Examples of entry and exit postings you may see in an experimental area are shown below.

<p style="text-align: center;"><b>Controlled for Volume Contamination</b></p> <p style="text-align: center;"><b>ENTRY REQUIREMENTS</b></p> <ul style="list-style-type: none"><li>• TLD Dosimeter Badge</li><li>• GERT* or RAD* Training</li></ul>
<p style="text-align: center;"><b>Controlled for Volume Contamination</b></p> <p style="text-align: center;"><b>EXIT REQUIREMENTS</b></p> <ul style="list-style-type: none"><li>• All material or equipment leaving this area must be surveyed by an RCT</li></ul>

\*General Employee Radiological Training (GERT) and Radiological Worker (RAD) Training.

These postings communicate several things. First, there is a reasonable potential for volume-contaminated materials in the area. The materials are usually not individually labeled as radioactive material as long as they remain in the area. Second, it states that you must wear a

TLD dosimeter and complete radiation training before entering. Third, it means that before removing any item (including a sample), you must contact an RCT (7-7069) to survey and tag the item with a label if it was in the room during beam operation. For specific instructions on how to get a sample surveyed and the appropriate label to use, see section II, 2 (for WNR) or section III, (for Lujan Center).

Once the RCT gets the survey results, he or she will replace the label with a “Health Physics Release Tag” or a “Health Physics Radioactive Materials Survey Tag.” Examples of the front and back of these tags is shown below.

**HEALTH PHYSICS RELEASE TAG**  
 Tag Number **B 001167**

Item Description \_\_\_\_\_

Individual Authorizing Release \_\_\_\_\_ Date \_\_\_\_\_

Note: Signatory certifies that exterior and interior surfaces of the item have been monitored according to LANSCE requirements.  
☐ Based on knowledge of process, no further monitoring is required.

Disposition (Release type)  
☐ Item is free from detectable radioactive contamination and may be released without controls.  
☐ Item has detectable radioactive contamination less than the levels specified in Figure 10-1 of DOE Order 5400.6.

Signature \_\_\_\_\_

Survey Date \_\_\_\_\_

Note: Signatory certifies that monitoring information is complete and correct.

**OK TO  
RELEASE**  
 (See other side  
of tag)

**HEALTH PHYSICS RADIOACTIVE MATERIALS SURVEY TAG**  
 Tag Number **B 26138**

Item Description \_\_\_\_\_

☐ Surface Contamination ☐ Internal Contamination  
☐ Fixed Contamination  
☐ Potential Internal Contamination

Survey of Item Material

Contamination Survey Results

Area	Survey Date	Survey Time	Survey Results
Surface Contamination			
Internal Contamination			
Fixed Contamination			
Potential Internal Contamination			

Survey of Potential Contamination

Survey of Potential Contamination Results

Area	Survey Date	Survey Time	Survey Results
Surface Contamination			
Internal Contamination			
Fixed Contamination			
Potential Internal Contamination			

Signature \_\_\_\_\_

Survey Date \_\_\_\_\_

**CAUTION**

**RADIOACTIVE MATERIAL**

☐ RADIOACTIVE MATERIAL

☐ INTERNAL CONTAMINATION

☐ POTENTIAL INTERNAL CONTAMINATION

☐ FIXED CONTAMINATION

(Check one - see other side of tag)

A “Health Physics Release Tag” means that you may remove the item to an uncontrolled area or from LANL. A “Health Physics Radioactive Materials Survey Tag” indicates two things:

1. the item is radioactive, and
2. it may only be moved to another area controlled for radiation.

Do not store an item(s) with a “Health Physics Radioactive Materials Survey Tag(s)” in uncontrolled areas. Only an RCT may remove the tag(s). Do not remove an item until the RCT places a release tag on the object. Make an arrangement with your host or local contact for returning items that cannot be released before your scheduled departure. Radioactive materials may be shipped according to Department of Transportation regulations, but special requirements apply.

Store activated (volume-contaminated) equipment and samples in a Radioactive Material Area (RMA) between uses or while waiting for radioactivity levels to drop enough so LANSCE can ship them back to you.

- Sometimes workers move items, such as samples or equipment, from a volume-contamination area to another location within a radiological controlled area. It is important to preserve the knowledge of a process about the item. Have an RCT survey and tag the item with a “Health Physics Release Tag” or a “Health Physics Radioactive Materials Survey Tag.”

**11.4. External Radiation Hazards.** We control many areas for external radiation. If a radiological-controlled area does not have the potential for contamination, we use the following posting:

<p style="text-align: center;"><b>Controlled for External Radiation</b></p> <p style="text-align: center;"><b>ENTRY REQUIREMENTS</b></p> <ul style="list-style-type: none"><li>• TLD Dosimeter Badge and PN-3 Badge</li><li>• GERT or RAD Training</li></ul> <p style="text-align: center;">**There may be EXIT REQUIREMENTS, check and follow any postings.**</p>
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The posting communicates two things. First, there is the potential for external radiation exposure in the area. Second, it states that you must wear a TLD and complete radiation training before entering. Exit requirements depend upon the situation; if there are any, they will be posted in the same location.

**11.4.1 Line D Beam-Line Hazard.** An accelerator beam line passes under a short section of La Mesita Road (the main road through LANSCE). In the extremely unlikely case of a beam-spill accident, there is a chance that dose rates in the area could exceed 25 rem per hour. Do not loiter in the area while the beam is on. A sign states, “No Stopping Next 50 Feet.” You will notice shielding blocks line both sides of the road in that area.



**11.5. Surface Contamination Hazards.** On rare occasions, Users may enter one of the few areas we control for surface contamination. An example of such an area is the Blue Room at WNR. We use the following posting:

<p style="text-align: center;"><b>Controlled for Surface Contamination</b></p> <p style="text-align: center;"><b>ENTRY REQUIREMENTS</b></p> <ul style="list-style-type: none"> <li>• TLD Dosimeter Badge</li> <li>• RAD Training</li> <li>• Protective Clothing</li> <li>• RWP</li> </ul> <p style="text-align: center;"><b>EXIT REQUIREMENTS</b></p> <ul style="list-style-type: none"> <li>• Every item and every person <b>MUST</b> be surveyed by an RCT.</li> </ul>		

The posting communicates three things. First, there is the potential that equipment, instruments, dust, etc., in the room may have surface contamination. Second, it states that you must wear a TLD and protective clothing, such as booties or coveralls, and that you must complete radiation training before entering. Third, to control spreading contamination to other areas, an RCT must survey everything, including people, as they leave the area. Additionally, an RWP will list the specific requirements.

Each entry or exit posting addresses one hazard. If multiple hazards are present in an area, there will be multiple postings. Look carefully at all the postings in an area.

#### **11.5.1 Personnel Contamination Monitor-1 (PCM-1)**

PCM-1 monitors at the main exits of ER-2 (Lujan Center) and the Blue Room (WNR) are sensitive and detect surface contamination that sticks to a person's clothing, skin or shoes. They can also detect radon gas. Radon is naturally occurring, but during beam operation, the levels of radon rise. As part of exiting the Blue Room, use the personnel contamination monitor.

You do not have to use the personnel contamination monitor **every** time you leave ER-1 or ER-2, but you should use it before exiting ER-2 at the end of the day or before taking a lunch break.

Perform the following steps to use the PCM-1:

<b>Steps</b>	<b>Action</b>	<b>Monitor Response</b>
1	Check the display at the top of the monitor to be sure that the monitor is ready to use.	The display should read "Counting Background Ready." If the display reads "Mandatory Background Check, Please Wait," wait until it displays "Ready" in the right-hand corner of the readout.

Steps	Action	Monitor Response
2	Step up into the monitor facing the left side of the monitor. Position your right foot on the floor detector.	
3	Following the diagram on the monitor, insert your right arm between two detectors.  Note: There is a micro-switch at the bottom screen for the arm monitor. Push your hand against the screen to start the count.	A small red light flashes to show that the monitor is counting. The monitor will not respond if your foot and arm are incorrectly positioned.
4	Hold the position until the count is complete.	The light stops blinking and a soft beep indicates that the count is complete. The display tells you to remove your right arm from the detector and repeat the process with your left side.
5	Remove your right arm and turn 180°.	
6	Insert your left arm between the two detectors and repeat the process for the left side.	
7	Hold the position until the count is complete.	A small red light flashes to show that the monitor is counting.
8	If the monitor detects no contamination, exit the monitor and record the results in the logbook next to the monitor.	The light stops blinking and a soft beep indicates the monitoring is complete.
9	If the monitor detects contamination, do not leave the area. Instead, immediately call for an RCT using the telephone next to the monitor (7-7069).	An alarm sounds.

**11.6. Chemical and Chemical Spill Hazards.** If you work directly with hazardous chemicals, you must work under the supervision of an authorized chemical worker. You may be in a work area where workers use chemicals. Some of these chemicals may be flammable, corrosive, poisonous, etc. Every chemical label describes the main safety hazards. We also keep a Material Safety Data Sheet (MSDS) for each chemical we use. The MSDS describes how to work with the

chemical safely. All LANL workers who use hazardous chemicals must be familiar with the MSDS, receive training, and follow LANL chemical safety requirements.

If you see a chemical spill, follow these steps:

Steps	Action
1	Do <b>NOT</b> clean up the spill. Secure your safety and the safety of others in the work area.
2	If the spill is large or poses an emergency, dial <b>911</b> .
3	If the spill is small, notify your local contact or instrument scientist.
4	If the spill is in an area with radiological hazards, dial <b>7-7069</b> from a LANL telephone to contact an RCT. Even a water spill in a radiological area may be radiologically hazardous.

**11.7 Pressure and Vacuum.** Instruments in experimental areas may use vacuum systems to operate or may require carrier gas. Some experiments and instruments may use pressure vessels. Only authorized workers, such as the instrument scientist, can operate, test or maintain such systems. Always obtain assistance from staff in these circumstances.

**11.8 Machine and Hand Tools.** We have several machine shops on-site. Typical mechanical hazards are present. We control these hazards by requiring that users take machine-specific training and obtain authorization from the shop supervisor before using a tool. If you require such access, discuss it with your local contact. Additionally, it is required that you **DO NOT** work alone in LANSCE machine shops.

**11.9 Crane Hazards.** Licensed crane operators work in ER-1 and -2 at the Lujan Center and Building 29. At the Lujan Center, cranes sound a warning horn when they start operation, and a light system flashes during operation. If you are in the area of crane operations, you are required to wear a hard hat. Pick up a hard hat at the entrances to the building and other designated areas and return hard hats after use or when exiting the area.

**11.10 Wildlife and Fire Hazards.** The LANSCE mesa is home to a variety of wildlife, such as snakes, mice (which pose Hantavirus hazards), scorpions, tarantulas, coyotes, etc. Do not handle wildlife. If you see wildlife droppings in the buildings, inform your local contact.

At times, LANL prohibits hiking, biking, running, and other non-work activities on undeveloped areas around the Laboratory because of changing fire hazard conditions in the area. Be alert to notices of changing conditions.

## **12. Abnormal Events and Emergencies**

If you see an emergency or incident, first get to safety. After you are in a secure location then perform one of the following steps to report the event.

<b>If you see...</b>	<b>Then...</b>
Fire or smoke	Pull the nearest fire alarm box.
	Call 911. Stay on the line until emergency help arrives.
	Notify the Facility Manager (the number is posted near the entry to every building).
A suspicious package or possible explosive device	Call 911. Stay on the line until emergency help arrives.
	Notify your host or contact who will alert the Facility Manager.
A medical emergency	Call 911 and ask for an ambulance. Stay on the line until emergency help arrives.
	Notify your host or contact who will alert the Facility Manager.
Other emergency or incident	Call 911. Stay on the line until emergency help arrives.
	Notify your host or contact who will alert the Facility Manager.

If you are not sure if an event is an emergency or if you cannot find your host or contact, call the Emergency Management and Response Office at 7-6211. For non-emergency events, call your host or contact.

### **13. Responding to Alarms**

Check the building emergency evacuation posters in buildings where you perform work. The posters show evacuation routes and muster areas in case of an emergency or building-wide alarm. If you hear an alarm, follow the steps listed below.

<b>If you...</b>	<b>Then...</b>
Hear an area-wide alarm (such as fire alarm, continuous air monitor, or area radiation monitor)	Leave the area.
	Assemble at the muster area.
	Wait until a manager or supervisor authorizes you to re-enter the building.
	Sometimes you must take secondary protective actions during emergency evacuations. For example, if a fire alarm sounds during a thunderstorm, it may not be safe for

If you...	Then...
	you to evacuate the building and assemble at the muster area. Instead, the Facility Manager or other authorized person may direct you to a sheltered area, perhaps in another building.
Receive a building-wide shelter-in-place announcement via a paging system, telephone, etc.	<p>Walk to the shelter-in-place location.</p> <p><b>Note:</b> Do not self-monitor before leaving an experimental area. Consider placing a handkerchief or a cloth over your mouth and nose to help prevent possible inhalation of contaminants (like smoke).</p>
	Follow instructions posted on the wall at the shelter location.
	If it is not possible or safe to reach the shelter-in-place , use a room where you can turn off the ventilation and close outside doors and windows. Remain there until you receive an “all clear” or other directions.
	<p><b>Note:</b> The shelter-in-place location for users at the Lujan Center is the Lujan Auditorium.</p> <p>The shelter-in-place location for Users at WNR is the Building 6 – Orange Box Conference Room.</p> <p>A map showing these shelter-in-place locations is included as Attachment A.</p>
Set off a portal monitor alarm or other personnel contamination monitor	Stay in the area.
	Call an RCT at 7-7069. The number is posted by the telephone near the monitor.
	Follow the RCT’s instructions.
Set off the gate alarm while exiting LANSCE	Pull over to the side of the road.
	Use the telephone near the guard gate to call an RCT at 7-7069.
	Follow the RCT’s instructions.

#### **14. Shipping, Transferring or Receiving Nuclear/Radioactive Material**

If you need to ship nuclear or radioactive materials to LANSCE, notify your local contact before shipping them. For the Lujan Center, contact Leilani Conradson at 505-667-6963 or [leilani@lanl.gov](mailto:leilani@lanl.gov). LANSCE must follow strict limits on the amount of such material allowed on-site.

Regardless of the level of radioactivity, assume all radioactive material must be shipped as radioactive material until told otherwise by a certified shipper. This decreases the probability of accident and the spread of contamination. Most often, Users should ship radioactive materials to HSR-1 at TA-53 rather than to individual scientists. This helps ensure that RCTs open, survey, and safely store radioactive material within 8 hours of arrival.

To transfer radioactive material within TA-53, contact an RCT. If you receive radioactive material from another area, such as samples, sources or equipment, you must call an RCT before opening the package. The RCT checks for leakage and determines any appropriate protective measures.

If necessary, make arrangements to have activated samples or equipment shipped to you after their radiation levels are low enough to meet legal transportation requirements. For the Lujan Center, contact Leilani Conradson at 505-667-6963 or [leilani@lanl.gov](mailto:leilani@lanl.gov). For WNR, ask your local contact.

#### **15. Managing your Waste**

Do not simply discard samples, waste or excess material that you generate as part of your work. Never pour liquid waste down a drain. Your host group will assist you with the waste you produce. Discuss any potential waste that you may generate BEFORE you begin work. Please recycle whenever possible. LANSCE has recycle containers for white paper, cardboard, and other materials.

#### **16. Returning Dosimeters, Other Badges, and Forms**

Return dosimeters, badges, and your completed User Satisfaction Survey to the LANSCE User Office at the end of your visit. If you leave LANSCE after business hours, drop them in the box at the gate. If the badge records a positive dose, LANL will notify you of your dose measurement within a few weeks. If the badge records no dose, LANL will mail the results to you during the first quarter of the next calendar year.

#### **17. You Are Responsible!**

Remember, you are responsible for your own safety and the safety of your coworkers. The safety controls that are in place are only as good as the people who use them. If you have questions, please ask your host or instrument scientist.

If you plan to work at WNR, continue to read section II. If you plan to work at the Lujan Center, go to section III, page 16.

## Section II: Specific Information for Users at WNR

Experiments and hazards on flight paths at WNR change constantly, often with each user group. The Experimental Area Manager is responsible for ensuring that workers perform operations within the safety envelope. He/she also coordinates all operations within the Lujan Center. You must obtain the Experimental Area Manager's approval before you make any changes to your experimental plan. The current Experimental Area Manager is Bruce Takala.

The following section describes specific hazards at WNR and how we control them.

### ***1. Beam Hazards and Controls***

Major radiation hazards exist only when the beam is running. With beam off, the Blue Room is typically posted as either a Radiation Area or a Radiological Buffer Area due to activated beam-line components and other apparatus. We use engineering controls, such as access control systems, and administrative entry controls to protect personnel.

LANSCe uses several personnel access control systems, including the Experimental area Personnel Access Control System (EPACS) and the older Personnel Safety System (PSS), to ensure that no one is in a high-radiation area while the beam is running.

Before beam delivery, an authorized worker secures the flight path by following a sweep procedure posted for the flight path. Listen for announcements over the paging system. For example, prior to starting a sweep in the Blue Room, a sweeper makes the following announcement, "Personnel safety sweep of the 2D Target (Blue Room) beam channel now in progress. All personnel leave the 2D Target (Blue Room) beam channel." When you hear this announcement, place your work in a safe configuration and leave. The sweep ensures that no person remains in the area.

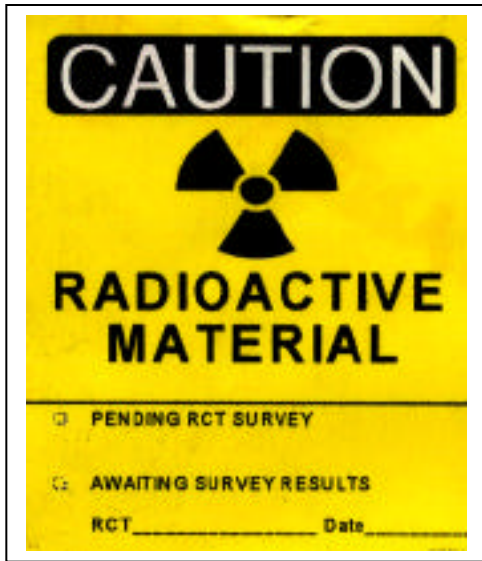
The flight path shutter will not open until all the sweep keys are in place and PSS shows that it is safe. A violation of a PSS shuts down all beams. While the beam runs, some areas- such as around Target 4 and the Blue Room- become exclusion areas.

You cannot enter the Blue Room after accelerator operation until an RCT and a Control Room Operator make the first entry. During a first entry, the RCT surveys for highly radioactive spots. Remember, when particles from the beam interact with material like beam line components, magnets, or shielding, the material may become radioactive. RCTs look for activated areas and post these areas. Coordinate your work in these areas with your local contact.

Communicate with the Central Control Room (CCR) before entering the Blue Room. Be sure to tell the operators at CCR approximately how long you expect to remain in the Blue Room. In the CCR operators direct beam operation and track conditions in the accelerator complex.

### ***2. Moving items that are Potentially Volume-Contaminated***

Before you remove any item (including a sample) from a radiological area controlled for volume or surface contamination, you must contact an RCT (7-7069) to survey and tag the item. However, an RCT may not be available to survey an item immediately. It is important to preserve knowledge of process about the item. Use the following "Caution, Radioactive Material" label to mark an item waiting for RCT survey:



When applying the label, be sure to mark the box “Pending RCT Survey.” Get labels from your local contact or instrument scientist.

Perform one of the following options to make sure that an RCT surveys the item before you remove it from an area controlled for volume contamination:

- place a “Caution, Radioactive Material” label on the item; or
- if the item is too small or awkwardly shaped, place the item in a container bearing the “Caution, Radioactive Material” label; or
- place the item (without a label) in a posted Radioactive Material Area (RMA). Enter the action in the RMA logbook. Your instrument scientist or local contact will show you the logbook.

The RCT checks the “Awaiting Survey Results” box and initials and dates the label after surveying the item.

### ***3. Surface Contamination Issues***

At times, the Blue Room is posted for surface contamination hazards. Follow all posted requirements.

### ***4. Buddy Principle in Blue Room and Blue Room Basement***

When in the Blue Room or its basement, follow the Buddy Principle. The Buddy Principle is an administrative control to reduce the risk of working alone in an isolated area. It strongly recommends you to maintain hourly voice or visual contact with another worker. If two workers are together and one must leave, the departing worker must find someone else to serve as the buddy.

### ***5. Egress Issues***

The Blue Room has only one exit. Before you perform any work that might affect the exit path, notify all occupants. They may stop their work and temporarily leave the area.



## ***6. Cryogenics***

If an experiment in the Blue Room requires the use of cryogenics, this creates two hazards; asphyxiation and exposure to extremely cold, and potentially dangerous materials. Asphyxiation becomes a concern if a system leaks and cryogenic gases displace air. We control this hazard with an engineering control- a low oxygen alarm or a carbon monoxide alarm. If you hear the alarm, exit the area immediately.

To protect yourself from cryogenic material burns, wear personal protective equipment when working near such materials. This includes insulated gloves, long-sleeved shirts, long pants, and safety glasses or face shields for your eyes.

## ***7. High Explosives***

At times, experiments at the Blue Room involve high explosive (HE) materials. To help control this hazard, we minimize the number of people allowed in the Blue Room when HE is present and follow requirements of a Hazard Control Plan (HCP). Your local contact will assist you with any requirements of an HCP.

## ***8. Target 4 Tunnel***

The access pipe from the entrance door maze to the Target 4 Tunnel is a non-permit confined space. Do not enter this area without an approved escort.

# **Section III: Specific Information for Users at the Lujan Center**

The Lujan Center has two main experimental rooms: ER-1 and -2. This section describes important contact information, specific hazards at the Lujan Center, and how these hazards are controlled. Remember, wear closed toe/ closed heeled shoes at all times in the experimental areas.

The Experimental Area Manager is responsible for ensuring that workers perform operations within the safety envelope. He/she also coordinates all operations within the Lujan Center. You must obtain the Experimental Area Manager's approval before you make any changes to your experimental plan. The current Experimental Area Manager is Ron Nelson

The instrument scientist is a Lujan Center staff member who is responsible for a specific instrument, for activities on a beam line, or for a flight path. The instrument scientist also coordinates activities for his/her area. Before you begin work at the Lujan Center, contact the appropriate instrument scientist. Names and contacts are in the LANSCE User Guide sent to you prior to your visit or you may obtain a copy from the User Office.

## ***1. Prompt Radiation Controls in Instrument Caves***

Many instrument enclosures (caves) use an access control system, called the Experimental Area Personnel Access Control System (EPACS), to control access during beam operation. The EPACS is a hardware system that includes interlocks and sets of special keys that prevent personnel from entering instrument caves when radiation levels are high. Before you open a shutter to operate the beam, you must receive training on the EPACS system.

## 2. Samples for Survey in ER-2

Wear gloves when handling samples exposed to the beam. Gloves are available at every instrument and at the HSR-1 survey table in ER-2. You must contact an RCT (7-7069) to survey and tag the sample or item before you remove it from ER-2. Sometimes an RCT is not available. In that case, you may use the User computer at the HSR-1 survey table to generate a label. The computer program prompts you to supply the information on the label, shown below:

<b>Sample/ Item To Be Surveyed By HSR-1</b>	
Name: _____	
Flight Path: _____	Date: _____
Phone: _____	Email: _____
Description of Sample/ Item: _____	
_____	
<b>ER1</b>	<b>ER2</b>
<i>Lujan Neutron Scattering Center</i>	

Print the label and attach it to the sample or sample container. Place the item or sample in the clear Lucite cabinet at the RCT station marked "Sample/ Item IN BOX". Once the RCT surveys and tags the item, the RCT places the item in the "Sample/ Item OUT BOX".

## 3. Samples for Survey in ER-1

Because of the proximity of the ER-1 experimental chambers to the beam, samples exposed to the beam in ER-1 have a much higher activation potential. Wear gloves when handling samples exposed to the beam. It is a good practice to notify an RCT **BEFORE** removing a sample from a beam line in ER-1. Whenever possible, an RCT arrives to survey the sample as soon as it is removed. In the unusual event that you cannot find an RCT, then label the sample as described in section III.2, and place it in the Lucite sample box at the RCT station in ER-2.

## 4. Tungsten Oxide Hazard

Water is used to cool the tungsten neutron-production target. In the extremely unlikely event that all of the many safety systems fail, it is possible that the tungsten target could sublime. The oxide powder is radioactive; if it disperses into the ventilation system and the air, it is hazardous to breathe.

A gamma detector near the target sounds if there is possible contamination from Target 1 operations. The CCR will make an announcement if it is necessary to take action. If an announcement is made, follow these steps:

Steps	Action
1	Exit ER-1 and ER-2. <b>Note: Do NOT use the personnel contamination monitor as you exit.</b>
2	Proceed to the shelter-in-place location, the Lujan Center Auditorium on the second floor.

Steps	Action
3	Follow the posted checklist at the shelter- in- place.
4	Remain in the Lujan Center Auditorium until an Experimental Area Manager or the Facility Manager releases you.

### **5. Overhead Hazards**

The ER-1 mezzanine has a low ceiling and overhead hazards. Wear a hard hat or bump cap when you are in the mezzanine or on top of a flight path. Hard hats can be found at each entrance to ER-1. Return them when you leave.

### **6. Forklift Hazards**

Licensed forklift operators work in ER-2 and around the Lujan Center. Listen for the “beeping” noises the forklifts sound when backing up and remain alert while forklift work is in progress. Users may not operate a forklift at LANSCE.

### **7. Fall/Trip Hazards**

The shielding on top of Lujan Center flight paths is uneven and may be slippery. Be careful when walking in this area. Guard- rails are in position along normally accessed areas on top of flight paths, for fall protection. Use additional fall protection if no guard- rails are available and the shielding is higher than six feet.

**8. Mercury Chemical Hazards.** The Lujan Center uses several mercury shutter systems to control delivery of neutrons from the 1L Target to the instruments. The mercury is in enclosed systems and containers, but during shutter repair or maintenance, mercury vapor may be released and spills can occur. Access to areas where maintenance or repair work on mercury systems is being performed should be limited to qualified personnel. A warning will be posted and the area will be barricaded.

At room temperature, mercury is primarily a metallic silver fluid. If you see a mercury leak or drops of mercury on the floor, contact your instrument scientist or Experimental Area Manager. Perform the steps listed below.

Steps	Action
1	Sound the evacuation alarm. Evacuation push- button alarms are located on walls in ER-2 and ER-1. See the photograph below, captioned “Evacuation push-button” to see what they look like.
2	Evacuate the area.
3	Assemble outside at the muster area.
4	Call your instrument scientist or Experimental Area Manager, who will alert the Facility Manager.  *NOTE: If after-hours, call Emergency Management & Response Team at 667-6211.

**9. Cadmium and Lead Hazards.** If you need to work with cadmium (Cd) or lead (Pb), discuss this with your local contact. Lead users must complete Lead training before working with it. Workers often use Cd and Pb, both toxic metals, for shielding in ER-1 and -2. Wear gloves to handle these materials and wash your hands after you are done. For further information about Cd and Pb, check their MSDSs.

**10. Confined Space Hazards.** Users may not enter areas posted as confined spaces. Discuss with your local contact if you need access to a confined space.

**11. Cryogenics/Low-Oxygen Hazards.** Scientists use cryogenics for some experiments at the Lujan Center. Follow postings in the area, which describe protective equipment, such as gloves or eyewear. LANSCE prohibits smoking or spark-producing items in the area. If cryogenics are released, they can displace the oxygen in the area. If you hear a low-oxygen alarm sound, evacuate the area and assemble at the muster area.

**12. High-Pressure/Vacuum Hazards.** If you need to use an instrument under high pressure or vacuum, read the Hazard Control Plan (HCP) for such work. The instrument scientist or local contact will provide you with the HCP before you use the instrument. If for some reason they have not yet done so, be sure to request it.

**13. Contamination Hazards.** ER-1 has the potential for radioactive contamination. Conditions in the room change, even within a day. Read entry postings to ensure you follow any additional requirements, such as wearing booties.

If an RCT determines that there is an increased chance of surface contamination in the area, the RCT will post a sign at the exit, requiring you to use the PCM-1 each time you exit.

#### **14. Limited Access Areas**

While the beam operates, ER-1 becomes a Limited Access Area (LAA). LANSCE controls entry to ER-1 through special training and badge readers during that time because it is close to the proton-beam delivery line going to WNR. In the highly unlikely event of a prolonged beam spill, workers in ER-1 could potentially receive significant radiation doses.

## Acronym List

Acronym	Definition
CCR	Central Control Room
EPACS	Experimental Area Personnel Access Control System
ER-1	Experimental Room 1
ER-2	Experimental Room 2
GERT	General Employee Radiological Training
HCP	Hazard Control Plan
HS&R	Health, Safety, and Radiation Protection
LANSCE	Los Alamos Neutron Science Center
LANL	Los Alamos National Laboratory
Lujan Center	Lujan Neutron Scattering Center
MSDS	Material Safety Data Sheet
NRTL	Nationally Recognized Testing Laboratory
pRad	Proton Radiography Facility
PN-3	Personal Neutron Dosimeter
PSS	Personnel Safety System
RAD Training	Radiological Worker Training
RCT	Radiological Control Technician
RMA	Radioactive Material Area
RWP	Radiological Work Permit
TA-3	Technical Area 3
TA-53	Technical Area 53 (LANSCE)
TLD	Thermoluminescent Dosimeter
WNR	Weapons Neutron Research Facility

## Definitions

**Activated material.** Material exposed to high levels of neutrons. The material becomes radioactive for a period of time after exposure.

**Administrative control.** Methods such as procedures, postings, permits, access restrictions, training, or time restrictions that help reduce hazards.

***As Low As Reasonably Achievable (ALARA).*** Radiological concept to manage and keep radiation exposures to the work force and general public as low as is reasonable.

***Authorization.*** The acceptance and approval by the appropriate level of supervision of (1) the adequacy of the control system (*work authorization*) or (2) a specific worker's knowledge, skills, and abilities to perform the work safely (*worker authorization*).

***Beam.*** The stream of protons from the accelerator is the primary beam.

***Blue Room.*** The WNR Target-2 area, where samples can be exposed to the direct 800-MeV proton beam.

***Buddy Principle.*** A requirement whereby an employee working in an isolated area must maintain hourly contact with a second person. If two people are working in an isolated area and one of them must leave, the one who leaves must find a new worker to serve as the buddy.

***Central Control Room (CCR).*** The CCR is located in Building 4 where operators direct beam operation 24 hours per day.

***Confined space.*** Areas that (1) are large enough so a worker can enter and perform work, (2) have limited access or egress, and (3) are not designed for continuous occupancy. Confined spaces are posted. Some require permits for entry.

***Contamination.*** Radioactive material in an unwanted location.

***Continuous-air monitor (CAM).*** Instrument that continuously measures the level of airborne radioactivity and sounds an alarm when the level exceeds the set point.

***Contamination area.*** An area in which the contamination level is greater than one time but less than 100 times the limits specified in Table 14-1 of LIR 402-700-01. The level of contamination requires contamination control measures.

***Controlled area (radiological controlled area).*** Any area to which access is managed by or for DOE to protect individuals from exposure to radiation and/or radioactive materials.

***Controlled area (volume contamination).*** An area where activation of materials is expected.

***Emergency Management and Response (EM&R) Group.*** The LANL group that is responsible for emergency management and response.

***Engineering controls.*** Structural or mechanical systems or tools that help reduce hazards.

***Experimental Area 1 (ER-1).*** Area at the Lujan Center equipped with instruments for neutron-scattering experiments. When beam is on, it becomes a radiation area. When beam is off, it is a radiologically controlled area.

***Experimental Area 2 (ER-2).*** Controlled area at the Lujan Center equipped with instruments for neutron-scattering experiments

**Health, Safety, and Radiation (HSR) Division.** HSR Division is responsible for delivering key services in areas of health, safety, and radiation protection.

**High explosive (HE).** An explosive (such as TNT) that rapidly generates gas and has a shattering effect.

**High radiation area.** Any accessible area where radiation levels could result in an individual receiving a deep dose equivalent in excess of 0.1 rem (100 mrem) in an hour at 30 cm from the source or from any surface that the radiation penetrates.

**La Mesita Road.** The main road at TA-53 that extends from East Jemez Road to the end of the TA-53 mesa.

**Limited access area.** Area posted as “Radiation Area” or “Controlled Area” under normal operating conditions, but under certain accident conditions, radiation dose rates might exceed 25 rem/hour.

**Linear accelerator (linac).** Proton (or electron or heavy ion) accelerator in which the paths of the protons accelerated are essentially straight lines rather than circles or spirals.

**Material Safety Data Sheet (MSDS).** Information sheet that concisely informs employees about the hazards of a specific material so that employees can protect themselves and respond to emergency situations

**Personnel Accountability Control System (PACS).** A hardware system, including sets of keys, which is used to keep personnel from beam areas or other areas where radiation levels may be high.

**PN-3 track etch dosimeter (“lemon badge”).** Instrument used to assess dose from neutron radiation when energies are greater than those measured by the TLD.

**Personal protective equipment (PPE).** Protective clothing or respirator equipment to help protect workers.

**Personnel contamination monitor (PCM) or (PCM-1).** A monitor placed at certain exits to measure surface contamination on a worker’s clothing or body. It sounds an alarm if contamination is detected.

**Portal monitor (PM).** A monitor that automatically measures radiation levels as personnel or equipment pass through it. It sounds an alarm if radiation level reaches a defined set point.

**Proton radiography (pRad).** Method that uses high-energy protons to look at an object (or an explosion). The object absorbs or scatters the protons. A magnetic lens system focuses the scattered protons into a clear image. The pRad facility enables high-resolution, time-dependant studies of dynamic events for the study of high-explosive detonation and burn, hydrodynamics and shock physics, and dynamic-materials properties.

**Radiation area.** Area with potential external radiation doses from > 5 mrem/hour at 30 cm from a source to 100 mrem/hour.

**Radiation controlled area.** Area with potentially removable contamination of up to 100 mrem/hour.

**Radiation Protection Automation System (RPAS).** A software system that tracks radiological issues and conditions at TA-53.

**Radiation Protection Services Group (HSR-12).** HSR-12 is responsible for programs that assist in protecting workers, the public, and the environment from radiological hazards.

**Radiation Security System (RSS).** Engineering control to reduce radiation exposure. The RSS includes beam plugs, beam-spill monitors (gamma detectors), beam-current limiters, and the Personnel Access Control System (PACS).

**Radiological Control Technician.** Qualified individual who provides routine and complex radiation support at assigned Laboratory sites. Performs workplace surveillance and analysis/interpretation of radiological data. Provides operational health-physics support to facility programs.

**Radiological Work Permit (RWP).** Permit that identifies radiological conditions, establishes worker protection and monitoring requirements, and contains specific approvals for radiological work activities. The RWPs serve as an administrative process for planning and controlling radiological work and for informing workers of radiological conditions- *LIR402-700-01.1, Occupational Radiation Protection Requirements*.

**Radon.** A colorless, radioactive, inert gaseous element formed by the radioactive decay of radium.

**Thermoluminescent Dosimeter (TLD).** Measures beta ( $\beta$ ), gamma ( $\gamma$ ), and x-rays and low- to mid-energy neutron-radiation doses for a worker.

**Volume-contaminated material.** Material that becomes radioactive activated throughout because of exposure to the accelerator beam.

**Weapons Neutron Research Facility (WNR).** The LANSCE facility (sponsored by LANSCE-3) that has two targets to provide neutron and proton beams for basic, applied, and defense-related research.



## Attachment A

